Divisional Application of USSN 09/112,757 filed on July, 10, 1998

TITLE OF INVENTION

"CASCADING IMAGE MODIFICATION USING MULTIPLE DIGITAL CAMERAS INCORPORATING IMAGE PROCESSING"

CROSS REFERENCES TO RELATED APPLICATIONS

The following Australian provisional patent applications are hereby incorporated by cross-reference. For the purposes of location and identification, US patent applications identified by their US patent application serial numbers (USSN) are listed alongside the Australian applications from which the US patent applications claim the right of priority.

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO7991	09/113,060	ART01
PO8505	09/113,070	ART02
PO7988	09/113,073	ART03
PO9395	6,322,181	ART04
PO8017	09/112,747	ART06
PO8014	09/112,776	ART07
PO8025	09/112,750	ART08
PO8032	09/112,746	ART09
PO7999	09/112,743	ART10
PO7998	09/112,742	ART11
PO8031	09/112,741	ART12
PO8030	6,196,541	ART13
PO7997	6,195,150	ART15
PO7979	09/113,053	ART16
PO8015	09/112,738	ART17
PO7978	09/113,067	ART18
PO7982	09/113,063	ART19
PO7989	09/113,069	ART20
PO8019	09/112,744	ART21
PO7980	6,356,715	ART22
PO8018	09/112,777	ART24

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO7938	09/113,224	ART25
PO8016	6,366,693	ART26
PO8024	09/112,805	ART27
PO7940	09/113,072	ART28
PO7939	09/112,785	ART29
PO8501	6,137,500	ART30
PO8500	09/112,796	ART31
PO7987	09/113,071	ART32
PO8022	09/112,824	ART33
PO8497	09/113,090	ART34
PO8020	09/112,823	ART38
PO8023	09/113,222	ART39
PO8504	09/112,786	ART42
PO8000	09/113,051	ART43
PO7977	09/112,782	ART44
PO7934	09/113,056	ART45
PO7990	09/113,059	ART46
PO8499	09/113,091	ART47
PO8502	09/112,753	ART48
PO7981	6,317,192	ART50
PO7986	09/113,057	ART51
PO7983	09/113,054	ART52
PO8026	09/112,752	ART53
PO8027	09/112,759	ART54
PO8028	09/112,757	ART56
PO9394	09/112,758	ART57
PO9396	09/113,107	ART58
PO9397	6,271,931	ART59
PO9398	6,353,772	ART60
PO9399	6,106,147	ART61
PO9400	09/112,790	ART62
PO9401	6,304,291	ART63
PO9402	09/112,788	ART64
PO9403	6,305,770	ART65
PO9405	6,289,262	ART66

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PP0959	6,315,200	ART68
PP1397	6,217,165	ART69
PP2370	09/112,781	DOT01
PP2371	09/113,052	DOT02
PO8003	09/112,834	Fluid01
PO8005	09/113,103	Fluid02
PO9404	09/113,101	Fluid03
PO8066	6,227,652	IJ01
PO8072	6,213,588	IJ02
PO8040	6,213,589	IJ03
PO8071	6,231,163	IJ04
PO8047	6,247,795	IJ05
PO8035	09/113,099	IJ06
PO8044	6,244,691	IJ07
PO8063	6,257,704	IJ08
PO8057	09/112,778	IJ09
PO8056	6,220,694	IJ10
PO8069	6,257,705	IJ11
PO8049	6,247,794	IJ12
PO8036	6,234,610	IJ13
PO8048	6,247,793	IJ14
PO8070	6,264,306	IJ15
PO8067	6,241,342	IJ16
PO8001	6,247,792	IJ17
PO8038	6,264,307	IJ18
PO8033	6,254,220	IJ19
PO8002	6,234,611	IJ20
PO8068	09/112,808	IJ21
PO8062	6,283,582	IJ22
PO8034	6,239,821	IJ23
PO8039	09/113,083	IJ24
PO8041	6,247,796	IJ25
PO8004	09/113,122	IJ26
PO8037	09/112,793	IJ27
PO8043	09/112,794	IJ28

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO8042	09/113,128	IJ29
PO8064	09/113,127	IJ30
PO9389	6,227,653	IJ31
PO9391	6,234,609	IJ32
PP0888	6,238,040	IJ33
PP0891	6,188,415	IJ34
PP0890	6,227,654	IJ35
PP0873	6,209,989	IJ36
PP0993	6,247,791	IJ37
PP0890	09/112,764	IJ38
PP1398	6,217,153	IJ39
PP2592	09/112,767	IJ40
PP2593	6,243,113	IJ41
PP3991	6,283,581	IJ42
PP3987	6,247,790	IJ43
PP3985	6,260,953	IJ44
PP3983	6,267,469	IJ45
PO7935	6,224,780	IJM01
PO7936	6,235,212	IJM02
PO7937	6,280,643	IJM03
PO8061	6,284,147	IJM04
PO8054	6,214,244	IJM05
PO8065	6,071,750	IJM06
PO8055	6,267,905	IJM07
PO8053	6,251,298	IJM08
PO8078	6,258,285	IJM09
PO7933	6,225,138	IJM10
PO7950	6,241,904	IJM11
PO7949	09/113,129	IJM12
PO8060	09/113,124	IJM13
PO8059	6,231,773	IJM14
PO8073	6,190,931	IJM15
PO8076	6,248,249	IJM16
PO8075	09/113,120	IJM17
PO8079	6,241,906	IJM18

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO8050	09/113,116	IJM19
PO8052	6,241,905	IJM20
PO7948	09/113,117	IJM21
PO7951	6,231,772	IJM22
PO8074	6,274,056	IJM23
PO7941	09/113,110	IJM24
PO8077	6,248,248	IJM25
PO8058	09/113,087	IJM26
PO8051	09/113,074	IJM27
PO8045	6,110,754	IJM28
PO7952	09/113,088	IJM29
PO8046	09/112,771	IJM30
PO9390	6,264,849	IJM31
PO9392	6,254,793	IJM32
PP0889	6,235,211	IJM35
PP0887	09/112,801	IJM36
PP0882	6,264,850	IJM37
PP0874	6,258,284	IJM38
PP1396	09/113,098	IJM39
PP3989	6,228,668	IJM40
PP2591	6,180,427	IJM41
PP3990	6,171,875	IJM42
PP3986	6,267,904	IJM43
PP3984	6,245,247	IJM44
PP3982	09/112,835	IJM45
PP0895	6,231,148	IR01
PP0870	09/113,106	IR02
PP0869	09/113,105	IR04
PP0887	09/113,104	IR05
PP0885	6,238,033	IR06
PP0884	09/112,766	IR10
PP0886	6,238,111	IR12
PP0871	09/113,086	IR13
PP0876	09/113,094	IR14
PP0877	09/112,760	IR16

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PP0878	6,196,739	IR17
PP0879	09/112,774	IR18
PP0883	6,270,182	IR19
PP0880	6,152,619	IR20
PP0881	09/113,092	IR21
PO8006	6,087,638	MEMS02
PO8007	09/113,093	MEMS03
PO8008	09/113,062	MEMS04
PO8010	6,041,600	MEMS05
PO8011	09/113,082	MEMS06
PO7947	6,067,797	MEMS07
PO7944	09/113,080	MEMS09
PO7946	6,044,646	MEMS10
PO9393	09/113,065	MEMS11
PP0875	09/113,078	MEMS12
PP0894	09/113,075	MEMS13

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

FIELD OF THE INVENTION

The present invention relates to a data processing method and apparatus and, in particular, discloses a Multi Artcam System.

The present invention further relates to the field of image processing and to user interface mechanisms for performing image processing.

BACKGROUND OF THE INVENTION

Recently, in Australia Provisional Patent Specification entitled "Image Processing Method and Apparatus (Art01)" filed concurrently by the present applicant, a system has been proposed known colloquially as "Artcam" which is a digital camera having an integral printer for printing out sensed images in addition to manipulations of the sensed image which are manipulated as a result of the insertion of a "Artcard" having manipulation instructions thereon into the camera.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide for a multi effect system to provide enhanced image effects.

In accordance with a first aspect of the present invention, there is provided a camera for creating and displaying a manipulated image, the camera comprising:

(a) image capture means configured to capture a real image and convert it to captured image data;

(b) input means configured to receive input image data from a source other than the camera;

(c) image manipulation means configured to receive the input image data from the input means and manipulate it to form a manipulated image;

(d) output means configured to receive the manipulated image from the image manipulation means and to output the manipulated image from the camera; and

(e) display means configured to receive the manipulated image from the image manipulation means and to display the manipulated image.

Preferably, the input means is configured to receive the input image from an input-image-providing camera.

Preferably, some or all of the input and output means comprise at least one USB or Firewire port.

In a preferred form, the output means is configured to output the manipulated image to a manipulated-image-receiving camera.

It is particular preferred that the display means comprise a printer device, the display means being configured to display the manipulated image by printing it.

It is also preferred that the camera further comprise a storage-device reader configured to read image manipulation instructions stored on a manipulation-instruction storage-device. In this case, it is preferred that the image manipulation means is configured to generated the manipulated image by manipulating the input image in accordance with image manipulation instructions received from a manipulation-instruction storage-device via the storage-device reader.

In accordance with a second aspect of the invention, there is provided a plurality of cameras for creating a manipulated image, the plurality of cameras including:

(a) a primary camera, comprising:

(i) image capture means configured to capture a real image as a primary captured image;

(ii) image manipulation means configured to manipulate the primary captured image to form a primary manipulated image;

(iii) image providing means configured to receive the primary manipulated image from the image manipulation means and provide the primary manipulated image to a secondary camera; and

(b) a secondary camera, comprising:

(i) image capture means configured to capture a real image as a secondary captured image;

(ii) image receiving means configured to receive the primary manipulated image from the image providing means of the primary camera; and

(iii) image manipulation means configured to receive the primary manipulated image from the image receiving means and manipulate the primary manipulated image to form a secondary manipulated image.

Preferably, the secondary camera further comprises display means configured to receive the secondary manipulated image from the image manipulation means and display it. More preferably, the display means comprises a printer device configured to print the secondary manipulated image.

In accordance with a third aspect of the invention, there is provided a method for forming a manipulated image, the method comprising the steps of:

(a) providing a primary camera, the primary camera comprising:
  (i) image capture means;
  (ii) image manipulation means; and
  (iii) image providing means; and

(b) providing a secondary camera, the secondary camera comprising:
  (i) image capture means;
  (ii) image receiving means; and
  (iii) image manipulation means,

the primary camera performing the steps of:

(c) capturing a real image as a captured image using the image capture means;

(d) manipulating the captured image using the image manipulation means to form a primary manipulated image;

(e) providing the primary manipulated image to the secondary camera via the image providing means; and

the secondary camera performing the steps of:

(f) receiving the primary manipulated image from the image providing means of the primary camera via the image receiving means of the secondary camera; and

(g) manipulating the primary manipulated image using the image manipulation means to form a secondary manipulated image.

In other aspects, the invention comprises manipulated images from primary or secondary cameras, the images preferably being in printed form,

BRIEF DESCRIPTION OF THE DRAWINGS

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings which:

Fig.1 illustrates the form of interconnection of the preferred embodiment.

DESCRIPTION OF PREFERRED AND OTHER EMBODIMENTS

The preferred embodiment is preferably implemented through suitable programming of a hand held camera device such as that described in USSN 09/113,060 (Docket No ART01) and USSN 09/112,757 (Docket No. ART56) filed concurrently herewith by the present applicant the content of which is hereby specifically incorporated by cross reference.

The aforementioned patent specification discloses a camera system, hereinafter known as an "Artcam" type camera, wherein sensed images can be directly printed out by an Artcam portable camera unit. Further, the aforementioned specification discloses means and methods for performing various manipulations on images captured by the camera sensing device leading to the production of various effects in any output image. The manipulations are disclosed to be highly flexible in nature and can be implemented through the insertion into the Artcam of cards having encoded thereon various instructions for the manipulation of images, the cards hereinafter being known as Artcards. The Artcam further has significant onboard processing power by an Artcam Central Processor unit (ACP) which is interconnected to a memory device for the storage of important data and images.

In the preferred embodiment, multiple Artcams as described in the aforementioned patent specification are interconnected via their USB ports so as to provide a cascading of imaging effects. Through suitable programming of the internal computer portions of each Artcam, a cascading of imaging effects can be achieved.

The preferred arrangement is as illustrated in Fig.1 wherein a series of Artcams, e.g. 2, 3, 4, are interconnected 5 via their USB ports. Each Artcam 2, 3, 4 is provided with a corresponding Artcard 7, 8, 9 having a suitable image manipulation program stored thereon. Further, the instructions for utilisation in a network environment can be provided on the Artcard 7, 8, 9. The image 10 sensed by the Artcam 2 is then manipulated by the manipulation program on Artcard 7 with the result being forwarded 5 to Artcam device 3 which applies the image manipulation function provided on Artcard 8 producing a corresponding output which is forwarded to the next

Artcam in the series. The chained Artcam has been modified so as to have two USB ports for this purpose. The final Artcam 4 applies its Artcard manipulation stored on Artcard 9 for producing output 12 which is a conglomeration of each of the previous image manipulations.

The arrangement 1 on Fig.1 thereby provides the opportunity to apply multiple effects to a single sensed image. Of course, a number of further refinements are possible. For example, each Artcam could print out its own manipulated image in addition to forwarding the image to the next Artcam in the series. Additionally, splitting of paths where one Artcam outputs to two different downstream Artcams which result in different final images being output could also be provided. Additionally, loops, etc., could be utilised.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiment without departing from the spirit or scope of the invention as broadly described. The present embodiment is, therefore, to be considered in all respects to be illustrative and not restrictive.

Ink Jet Technologies

The embodiments of the invention use an ink jet printer type device. Of course many different devices could be used. However presently popular ink jet printing technologies are unlikely to be suitable.

The most significant problem with thermal ink jet is power consumption. This is approximately 100 times that required for high speed, and stems from the energy-inefficient means of drop ejection. This involves the rapid boiling of water to produce a vapor bubble which expels the ink. Water has a very high heat capacity, and must be superheated in thermal ink jet applications. This leads to an efficiency of around 0.02%, from electricity input to drop momentum (and increased surface area) out.

The most significant problem with piezoelectric ink jet is size and cost. Piezoelectric crystals have a very small deflection at reasonable drive voltages, and therefore require a large area for each nozzle. Also, each piezoelectric actuator must be connected to its drive circuit on a separate substrate. This is not a significant problem at the current limit of around 300 nozzles per print head, but is a major impediment to the fabrication of pagewide print heads with 19,200 nozzles.

Ideally, the ink jet technologies used meet the stringent requirements of in-camera digital color printing and other high quality, high speed, low cost printing applications. To meet the requirements of digital photography, new ink jet technologies have been created. The target features include:

low power (less than 10 Watts)

high resolution capability (1,600 dpi or more)

photographic quality output

low manufacturing cost

small size (pagewidth times minimum cross section)

high speed (< 2 seconds per page).

All of these features can be met or exceeded by the ink jet systems described below with differing levels of difficulty. 45 different ink jet technologies have been developed by the Assignee to give a wide range of choices for high volume manufacture. These technologies form part of separate applications assigned to the present Assignee as set out in the table below.

The ink jet designs shown here are suitable for a wide range of digital printing systems, from battery powered one-time use digital cameras, through to desktop and network printers, and through to commercial printing systems

For ease of manufacture using standard process equipment, the print head is designed to be a monolithic 0.5 micron CMOS chip with MEMS post processing. For color photographic applications, the print head is 100 mm long, with a width which depends upon the ink jet type. The smallest print head designed is IJ38, which is 0.35 mm wide, giving a chip area of 35 square mm. The print heads each contain 19,200 nozzles plus data and control circuitry.

Ink is supplied to the back of the print head by injection molded plastic ink channels. The molding requires 50 micron features, which can be created using a lithographically micromachined insert in a standard injection molding tool. Ink flows through holes etched through the wafer to the nozzle chambers fabricated on the front surface of the wafer. The print head is connected to the camera circuitry by tape automated bonding.

Although the invention has been described with reference to a number of specific examples, it will be appreciated by those skilled in the art that the invention can be embodied in many other forms.